Loviisa nuclear power plant

Needs and future developments in measurement at NPP

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Loviisa nuclear power plant

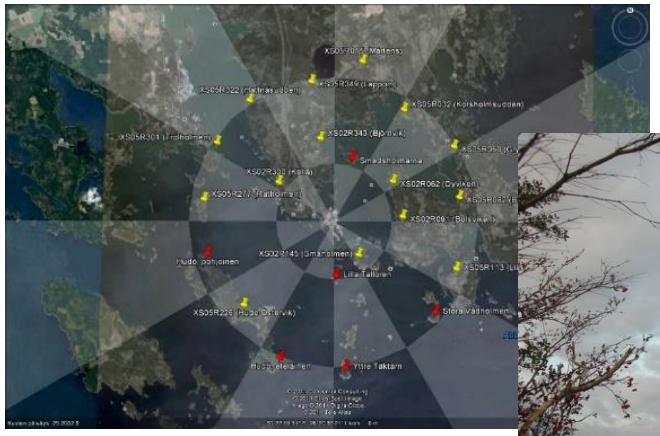
- Loviisa power plant has two VVER pressurised water reactors, with capacities of 507 MW net
- Loviisa 1 was commissioned in 1977 and Loviisa 2 in 1980
  - Operating license for Loviisa 1 is valid until the end of 2027 and Loviisa 2 until the end of 2030
  - Application process for operation licence extension ➔ 2050 is ongoing

- The original radiation monitoring systems have been modernized is several steps during the operation of the plant
- Also completely new radiation monitoring systems has been installed over the years

General description

Radiation monitoring at Loviisa NPP consists of several independent systems

- Plant process, area, and release radiation monitoring system (RMS)
  - Over 150 measurement channels (air, doserate, process water, release, accident, Severe Accident Monitoring)
- Environmental monitoring system
  - Dose rate monitoring system in vicinity of plant
- Personnel contamination monitoring system
- Dose monitoring of personnel
  - TLD and electronic dosimetry
- Radioactivity monitoring of transports and personnel
  - Transport monitoring, personnel walk through monitoring, tool monitoring
- Number of different dose rate and contamination monitoring instruments for operative radiation protection purposes (including gamma camera, tool and object monitors, large area radiation scanner for floor monitoring)



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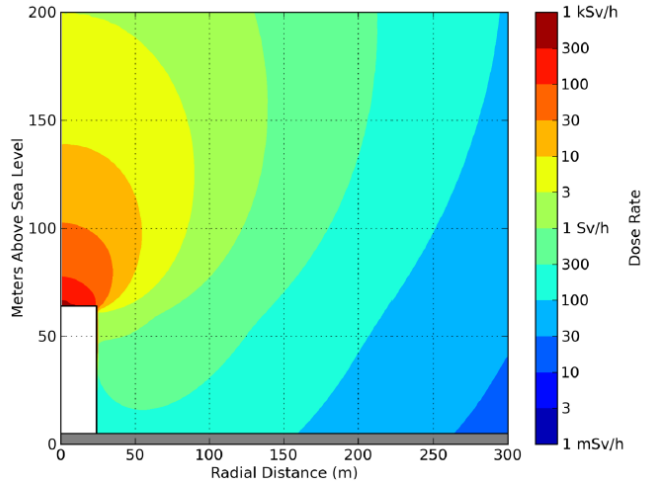
Future considerations

- Radiation monitoring systems are needed during the operation of the plant and some 30 years after that, in Loviisa's case this means eather 2060 or ca. 2080 depending on the operating licence extension
  - Process monitoring and accident monitoring is needed as long as nuclear fuel remains on site
- Based on the experience the life span of RMS varies from 15 to 30 years
  - The need for modernization might arise for example from spare part availability, user needs, requlatory requirements or plant modifications (system or plant layout modifications)
- Each radiation monitoring system renewal in the past has meant not only renewal but improvement and extension of the old system based on user experience
    - For example personnel contamination monitoring system renewal in 2005-2007
      - not only replacement by new equipment but a large plant layout modification to enable more logical personnel entry and exit to RCA
      - Integration of electronic dosimetry hardware and software to the personnel contamination monitoring system to enable better follow up of contamination events
- Each generation of new equipment has provided better information than the previous one (trending, diagnostics)

Future considerations, examples

- Main part of Loviisa NPP's RMSystem was renewed during 2001-2003
- A preliminary study has been started to evaluate what improvements are needed when next renewal is due
  - The study will create a roadmap of when and what measurements need to be modified of renewed rather than just replaced by new equipment
  - New accident analysis have bought new insights for how to relocate some of the monitors
  - More expandibility (mobile detectors that could be connected to the main system to allow specific work place monitoring in real time)
- Environmental monitoring system renewed and expanded 2013-2014
  - Current system consists of dose rate monitoring (battery operated probes with GPS)
  - Future: gammaspektrometry in some locations? Drones for accident monitoring?
- Electronic dosimetry system originally installed in 2003, updated 2021-2022 (new dosimeters, neutron dosimetry, new readers)
  - Future?
    - Teledosimetry applications for better work place monitoring.
    - Could the dose and doserate information from the electronic dosimeter be shown in the safety goggles (improvement of worker awareness)



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Summary

- Radiation monitoring at an old NPP is a broad and versatile entity and it consists of a large variety of different kinds of measurements that have been installed in different stages of plant operation
- Life span of radiation monitoring systems can be surprisingly short due to obsolescence of electronic components
- When systems are renewed, current reg requirements have to be applied. Usually the requirements mount up ovet time
- In system renewals it is crucial to make detailed analysis of the measurement conditions specially when it comes to accident situation measurements
- When systems are modified or renewed, more concideration shoud be given to information availability and user interfaces

Thank you for your attention – time for questions

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